

Preface

The story of this book begins with the question “*How did life originate and why were left-handed molecules selected for its architecture?*” It is widely known that in processes triggering the origin of life on Earth, the equal occurrence, the parity between left-handed amino acids and their right-handed mirror images, is violated. The balance is inevitably tipped to the left – provoking that life’s proteins today exclusively implement the left form of amino acids.

Why to the left?

If we rerun the tape of life’s origin, would we once more obtain today’s life using the left form of amino acids? Can’t we think of mirror image life made of right-amino acids? Did mirror image life exist on Earth or does it exist somewhere else? What would mirror image life look like and how would it interact with the environment and with us? Puzzling questions of this kind contributed to the awakening of public interest in symmetry, the hypothetical existence of mirror image life, and its properties. Symmetry phenomena like these made also me curious and I began to separate molecules from their mirror image forms.

After several attempts, we were lucky to be engaged in the construction of the “Chirality-Module” of the ambitious cometary mission ROSETTA, an instrument designed to land on a comet and search for molecules and their mirror image forms. The idea is to trace the origin of life’s left-handedness back to outer space.

Indeed, when we produced a comet analogue in the laboratory, we found a wide variety of amino acid molecules and their mirror image forms therein. The results supported not only the concept of the extraterrestrial delivery of prebiotic molecules triggering the appearance of life on Earth, now well-known and highly cited, but it provided a source of motivation in devoting an entire book to all the fascinating phenomena related to the asymmetry of life and its origin.

It is probably true that most scientists are solving more applied problems in biology, chemistry, physics, and mathematics. But we should always be alert to the great problems, such as understanding the processes leading to the origin of the one-handedness of life. Given past experience, such great questions will be solved – not by chance but by the prepared mind (Penny 2006). This book aims to be a starting

point for the preparation of that mind by becoming a valuable resource for courses in chemistry, biology, biochemistry, and physics.

As Professor in Physical and Bioanalytical Chemistry, I was fortunate to work with and learn from Wolfram H.-P. Thiemann at the University of Bremen. He introduced me to the intriguing field of chirality, to theories on the origin of biomolecular asymmetry, and to the ROSETTA-COSAC community.

The international collaboration in my research field on the origin of life's molecular asymmetry was originally initiated by Helmut Rosenbauer at the Max Planck Institute for Solar System Research in Katlenburg-Lindau, Germany, via the ambitious conception and preparation of the COSAC-experiment onboard the ROSETTA Lander. My thanks go to Helmut Rosenbauer for this scientific support and his colleagues Fred Goesmann, Martin Hilchenbach, and Reinhard Roll for their fascinating basic work on COSAC and for plenty of conferences in the midst of fruitful discussions.

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